WHAT IS CLAIMED IS:

1. An infrared photodetector, comprising:

a conducting layer;

a semiconductor layer comprising at least one layer of quantum structure for confining a carrier in a barrier;

an insulating layer formed between said conducting layer and said semiconductor layer; and

a voltage source connected to said conducting layer and said semiconductor layer for providing a bias voltage to generate a quantum tunneling effect, such that said carrier penetrates through said insulating layer to form a current;

wherein when irradiated by an infrared, said carrier in said barrier absorbs the energy of said infrared to jump out of said barrier and is collected by an electrode to form a photocurrent.

2. The infrared photodetector according to claim 1 wherein said conducting layer is one of an aluminum layer and a doped polysilicon layer.

3. The infrared photodetector according to claim 1 wherein said conducting layer is a transparent conductor.

4. The infrared photodetector according to claim 3 wherein said transparent conductor is made of indium tin oxide (ITO).

5. The infrared photodetector according to claim 1 wherein said conducting layer is one of a reticular conducting layer and a lattice conducting layer.

6. The infrared photodetector according to claim 1 wherein said semiconductor layer is one of a p-type semiconductor and an n-type semiconductor.

7. The infrared photodetector according to claim 1 wherein said quantum structure is one of a quantum dot and a quantum well.

8. The infrared photodetector according to claim 1 wherein said semiconductor layer comprises a Si substrate and plural layers of quantum structures formed on said Si substrate.

9. The infrared photodetector according to claim 1 wherein said quantum structure comprises a Ge wetting layer, a Ge quantum dot and a Si layer.

10. The infrared photodetector according to claim 1 wherein said insulating layer is a silicon oxide layer.

11. The infrared photodetector according to claim 1 wherein said insulating layer has a thickness of 1 to 10 nm.

12. The infrared photodetector according to claim 1 wherein said insulating layer is formed by a liquid phase deposition.

13. An infrared photodetector, comprising:

a conducting layer;

a p-type semiconductor layer comprising at least one layer of quantum structure for confining a carrier in a barrier;

an insulating layer formed between said conducting layer and said p-type semiconductor layer; and

a voltage source with a positive electrode connected to said conducting layer and with a negative electrode connected to said p-type semiconductor layer for providing a bias voltage to generate a quantum tunneling effect, such that said carrier penetrates through said insulating layer to form a current;

wherein when irradiated by an infrared, said carrier in said barrier absorbs the energy of said infrared to jump out of said barrier and is collected by said electrode to form a photocurrent.

14. An infrared photodetector, comprising:

a conducting layer;

an n-type semiconductor layer comprising at least one layer of quantum structure for confining a carrier in a barrier;

an insulating layer formed between said conducting layer and said n-type semiconductor layer; and

a voltage source with a negative electrode connected to said conducting layer and with a positive electrode connected to said n-type semiconductor layer for providing a bias voltage to generate a quantum tunneling effect, such that said carrier penetrates through said insulating layer to form a current;

wherein when irradiated by an infrared, said carrier in said barrier absorbs the energy of said infrared to jump out of said barrier and is collected by said electrode to form a photocurrent.